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assortive mating in Chromodoris. If the population is composed of a mixture of pure lines, then one effect of this type of copulation may well be, as in Paramecium (Jennings), the prevention of interlinear crossing. Certain generally accepted ideas regarding the life history of nudibranchs may tend to favor this view. The evidence for the presence of pure lines in the Chromodoris stock is, however, entirely inferential. It would, indeed, be almost impossible to obtain good evidence upon this point, unless, possibly, through a study of the rate of segmentation of the eggs; but the eggs of C. zebra are not well adapted for this work, and it is very doubtful if such evidence could be made conclusive.

Another, and, I believe, at present better founded, suggestion concerning the effect of assortive mating is based upon the fact that the size of the egg-masses, and the number of eggs in each ribbon, as well, probably, as the number of egg masses deposited by each animal during a single season, increase directly with the size of the individual. On grounds of physiological economy—remembering that mutual fertilization is involved, and remembering also that each animal deposits a number of egg-masses at each spawning season—it may be argued that the mating of large individuals is an influence tending to increase the number of larvae beyond that which would result from random pairing. In some other nudibranchs assortive mating, if it occurs, may have a different, or an additional, significance.

Summary.—Mating pairs of the nudibranch Chromodoris zebra are found to exhibit a rather high degree of correlation between the sizes of the two members. This is due to assortive mating, which may constitute an important influence tending to increase the numbers of larvae.

[1] Contributions from the Bermuda Biological Station for Research, No. 70.

[2] It was necessary to remove the animals from the water and place them, dorsal surface downward, upon a glass plate.

CORAL REEFS OF TUTUILA, WITH REFERENCE TO THE MURRAY AGASSIZ SOLUTION THEORY

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Tutuila, Samoa, is a purely volcanic island without elevated coral reefs or limestones. It is surrounded by a recent fringing reef which forms a mere veneer over the modern off-shore marine platform, and extends a short distance seaward, its precipitous outer edge being from

5 to about 20 fathoms deep. In former times, the island may have been submerged about 20 fathoms below its present level, this being suggested by the fairly uniform depth of about 20 fathoms off the mouths of the harbors of the northern coast, while these harbors themselves have the appearance of drowned valleys.

However this may be, the latest movement of the island has been an emergence of about 8 feet above present high-tide level; for a platform about 8 feet above high tide juts out to seaward from the base of practically every promontory. The shores are strongly cliffed, some of the sea-cliffs being 500 feet high.

Being volcanic and densely forested from summit to shore, it was thought that rain-water falling upon the island might become so augmented in acidity as to dissolve the shoreward parts of the surrounding coral reef. This, however, is untrue. The rain-water is indeed acid, ranging from 0.126 to 0.678 $\times 10^{-5}$. However, the streams and springs of the island are usually slightly *alkaline*, due to bicarbonates; the average of 11 of the principal streams and 6 springs being 7.19 PH., or 0.645 $\times 10^{-7}$ hydrogen-ion concentration, and the range from 0.25 $\times 10^{-6}$ to 0.38 $\times 10^{-7}$.

An analysis of the water from Faagalu stream below the water-falls was made by Prof. Alexander H. Phillips, and shows a high percentage of chlorine, and bicarbonates and very little ammonia, or nitrates. The calcium, magnesium sodium and potassium are more than sufficient to hold the bicarbonates, HCO_3, in an ionic state.

The following is an abstract of Professor Phillip's analysis of Faagalu stream water.

Sample taken April 14, 1917

	Parts per million		*Parts per million*
Free Ammonia	0.036	Magnesium (Mg)	2.20
Albuminoid ammonia	0.028	Sodium (Na)	6.19
Nitrogen in nitrites	none	Potassium (K)	2.16
Nitrogen in nitrates	0.04	Bicarbonate (HCO_3)	9.60
Oxygen consumed	2.05	Sulphate (SO_4)	4.06
Total solids	70.06	Chlorine (Cl)	12.00
Silica (SiO_2)	26.55	Nitrate (NO_3)	.17
Iron(Fe_2O_3) are Alumina (Al_2O_3)	0.95	Phosphate (P_2O_5)	.026
Calcium	3.03	Hydrogen ion concentration of the water 0.5×10^{-7}.	

It is evident that the calcium is too great in proportion to the sodium to have been derived from the salt spray, and must therefore have come from the rocks or the decaying vegetation of the Island.

In Oahu, Hawaiian Islands, also, the streams are alkaline, for Dr.

C. Montague Cooke, Jr. of Honolulu, kindly transported me in his automobile to eight of the larger streams and springs, between Palolo and Monanalua valleys, and these were all alkaline, ranging from 7.1 to 8.12 PH.; the average being 7.34 PH. or 0.457×10^{-7}. The higher alkalinity of the streams of Oahu may be due to the presence of elevated limestones, these being absent from Tutuila. Thus the surface waters draining off from Tutuila, and Oahu, being alkaline, cannot dissolve limestones by reason of their 'acidity,' and the Murray-Agassiz theory of solution of the shoreward parts of reef flats by fresh water is not supported.

The openings in coral reefs opposite the mouths of streams are due to the fact that corals cannot survive and have never grown, in these places, due to silt and dilution in time of flood. This was proven at Tutuila by placing 26 specimens of 12 species of Acropora, Pavona, Psammocora, Porites, Pocillopora, Fungia, and Coeloseris, 150 feet from the mouth of Pago Pago brook in a place where the bottom is covered with fine brown volcanic mud and no corals are found. The salinity in this situation was observed to range between 31.38 to 25.48; that of the open sea about being 34.83. Yet the corals survived in this diluted water, for fifteen days, although the Acroporas did not expand. However all but one species were killed by the freshet due to the torrential shower of 4.3 inches on April 12, 1917, which reduced the salinity to 0.93, becoming only 9.25 at the end of 24 hours. All the corals died with the exception of 2 out of 3 specimens of massive *Porites* which withstood the dilution and silt but with apparent injury. This species of *Porites* lives nearer to streams mouths and closer to the shore than does any other coral of Samoa.

It is apparently uninjured by being placed for an hour in water of a constant temperature of 36° C., which would be fatal to all the *Acropora*, *Pocillopora* and dominant off-shore corals of the reefs.

On the reef flats of both Murray Island, Australia, and Tutuila, Samoa, coral heads are most densely clustered in relatively quiet water about 150 to 200 feet shoreward from the region wherein the surges die out in ordinary weather.

The greatest variety of species of corals are, however, found just where the surges die out in ordinary weather.

In both Murray Island, Australia, and Tutuila, Samoa, four genera constitute over 90% of the coral heads of the reef flats. Thus:

NAME OF CORAL	PERCENTAGE OF CORAL HEADS	
	Murray Island, Australia	Tutuila, Samoa
	per cent	*per cent*
Porites	38	47.4
Acropora	18	33.6
Pocillopora	10	4.01
Psammocora	Very rare	10.0
Seriatopora	25	0.0
Totals	91	95.1

It was found that when shallow reef-flats are impounded and cut off for about an hour from the open ocean at low tide, the water quickly becomes nearly twice as alkaline in places as in the open ocean, while in other places it becomes abnormally reduced in alkalinity. The increase in alkalinity is caused by the photo-synthetic action of plant cells within the corals and by sea weeds.

Rail falling directly into the sea has far more effect in reducing the alkalinity of the surface water than has stream water pouring outward from the shore. Yet the torrential rain of 7.8 inches in about five hours on March 19 reduced the surface alkalinity only from 8.20 to 8.18 PH., and the salinity from 34.69 to 30.46 off the landing-stage of Blacklock's wharf near the inner end of Pago Pago Harbor, and the alkalinity of the harbor remained about 34.33 despite the average rainfall of more than one inch per day from January 1 to April 17.

The scouring of sand from their floors by currents is a potent factor in deepening the shoreward parts of the reef-flats, and may result in changing a fringing reef into a barrier reef. The lithothamnion ridge lying along the seaward edge withstands this process of disintegration for by growing, it resupplies such loss and maintains itself about 6 inches above low tide level. The corals growing over the shoreward parts of the reef-flats also tend to replace the lost limestone and some reefs may thus maintain themselves as fringing reefs, as at Aua, Pago Pago Harbor, while others as at Black's Bay, Tutuila, become deepened near shore so as to change into barrier reefs. At Aua the current over the reef-flat ranges from 20 to 62.8 feet per minute, and is an effective transporter of coral sand; spilling it into deep water off the northern edge of the reef. This scouring process is doubtless facilitated by the holothurians which are well known to be sand swallowers. There is on the average one of these animals for every 8.6 square feet of reef flat off Aua, Pago Pago Harbor.

It is our hope to return to Samoa in 1918 to remeasure and re-weigh corals, and thus determine their growth rate, and to bore through the coral reef, study the question of the existence or non-existence of a submerged marine platform, and evaluate the sand-carrying ability of currents over the reef flats, and of solution due to holothurians. The results may then be published by the Carnegie Institution of Washington.

It is a pleasure to express our gratitude to Hon. Josephus Daniels, Secretary of the Navy; and also to His Excellency, Governor John M. Poyer, Commander U. S. N., and his officers who did all in their power to facilitate our studies.

NATIONAL RESEARCH COUNCIL

SUGGESTIONS RELATING TO THE NEW NATIONAL ARMY BY THE ANTHROPOLOGY COMMITTEE OF THE NATIONAL RESEARCH COUNCIL

The recruiting of a large army from the diversified elements of the national population must present certain contingencies in which Physical Anthropology may be of much practical service, and at the same time should afford many opportunities by the utilization of which this and related branches of science may greatly benefit.

1. Examination of Recruits.—The examination of recruits for admission into the new Army will include certain observations which, if properly systematized and made by simple, accurate, standardized instruments, should prove of great statistical value. Unhappily the methods followed today and the instruments by which the measurements are taken lack in uniformity as well as in accuracy. Unless a few necessary improvements are made in both, the great body of data derived from the examination of a million or more men cannot be utilized by science with full confidence; and as properly revised regulations would not increase, but actually diminish the burdens of the examiners, the Committee on Anthropology takes the liberty of urging immediate consideration of the question of revision. Suggested modifications of the present examination blanks and specifications for simple outfits of instruments, together with directions for the examiners in making measurements and physical observations have already been submitted by the Committee to the National Research Council.

In this as well as in other recommendations which the Committee has made the utmost care was taken not to add to, but rather to reduce the burdens of the medical examiners and the medical service of the army. No additional tasks at this time unless of the highest practical importance would be justifiable or feasible.